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DETERMINATION OF PHYSICO-CHEMICAL PARAMETERS OF PARMANAND NAGAR, POND RAIPUR, (C.G) INDIA

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ABSTRACT

Water is the physical foundation of all living things. It is necessary for our bodies growth and function since it is involved in a variety of biological activities. Drinking water is an essential component for all living things. Groundwater is an important natural resource that contributes to human health, economic prosperity, and biological variety. The current research focuses on determining physico-chemical characteristics in water samples from various sampling places, such as pH, EC, hardness, alkalinity, DO, BODs, and COD. An rise in pollution concentration indicates an increase in pollution load due to domestic sewage and industrial effluents, as well as anthropogenic activities and garbage discharge into the Raipur district's river. The physico-chemical properties of surface water collected from four locations along the Parmanand Nagar River in Kota, Raipur, were analyzed.

KEY WORDS : Drinking Water, Groundwater, Physicochemical Parameters.

1. INTRODUCTION:

Water is the most important component of every ecosystem. Rivers, lakes, glaciers, rainwater, groundwater, and other water sources are the most common. Aside from drinking water, water resources are important in a variety of industries, including agriculture, animal production, forestry, industrial operations, hydropower generation, fishing, and other creative endeavours. Because of key reasons such as rising population, industrialization, and urbanisation, the availability and quality of water, whether surface or ground, has deteriorated [1] Groundwater is utilised all around the world for household and industrial water supplies, as well as agriculture. The fast rise of population and the increased pace of urbanization have resulted in a massive increase in the demand for fresh water during the last several decades. Water is responsible for around 80% of all human illnesses, according to the World Health Organization [2]. The most important natural resource is water. Accepting the importance and lack of resources for biological requirements, as well as supporting economic and growth activities of all types, is a major problem [3]. The availability of high-quality water is essential for prevention of disease and improved quality of life. Impurities are delivered into the aquatic system in a variety of ways, including weathering of rocks and leaching of soils, dissolving of aerosol particles from the atmosphere, and a variety of human activities, including as mining, processing, and the usage of metal-based products [4]. Unwanted changes in the physical, chemical, and biological features of air, water, and soil pose a serious hazard to people all over the world. These are linked to animals and plants, and ultimately have an impact on them [5]. Industrial development (either new or existing industry expansion) results in the generation of industrial effluents, and if untreated results in water, sediment and soil pollution [6-7].

"Water pollution is defined as" the addition of chemicals or energy forms to a water body that adversely affects its authorised usage by altering the character of the water body directly or indirectly." Pollution diminishes a body of water's capacity to deliver ecosystem services that it might otherwise give. Lakes, rivers, seas, aquifers, reservoirs, and groundwater are examples of water bodies [8]. Although this fact is widely recognized, pollution of water resources is a common occurrence. Potable water, in particular, has been severely harmed, and in many cases has lost its basic purpose. There are many different types of water contamination, but there are two basic types: direct and indirect pollutant sources. Direct sources include effluent outfalls from industries, refineries contaminants that enter to water supply from soils/ground water systems and from the atmosphere via rain water. Industrial solvents, volatile organic compounds, insecticides, pesticides, and food processing wastes are examples of organic water contaminants. Metals, fertilisers, and acidity induced by industrial discharges are examples of inorganic water contaminants [9].

High levels of pollutants in river water systems causes an increase in biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), toxic metals such as Cd, Cr, Ni and Pb and faecal coliform and hence make such water unsuitable for drinking, irrigation and aquatic life. Industrial effluent contamination of natural water bodies has emerged as a major challenge in developing and densely populated countries like India. Estuaries and inland water bodies, which are the major sources of drinking water in India, are often contaminated by the activities of the adjoining populations and industrial establishments [10].

2. MATERIALAND METHODS:

2.1 Study Area:

Raipur city is located near the centre of the vast and fertile Chhattisgarh plain. The city is situated between 22°33'N and 21°14'N latitude and 82°6'E to 81°38'E longitude. The city averagely situated 298m above sea level has a total land size of about 226 km^2. The waste water samples were collected from the parmanand nagar, kota, Raipur, Chhattisgarh in afternoon between 11.00 am to 12.00 pm. Water samples were collected from four points for physico-chemical analysis. This site is situated in 21.2618°N latitude and in 81.6056° E longitude.

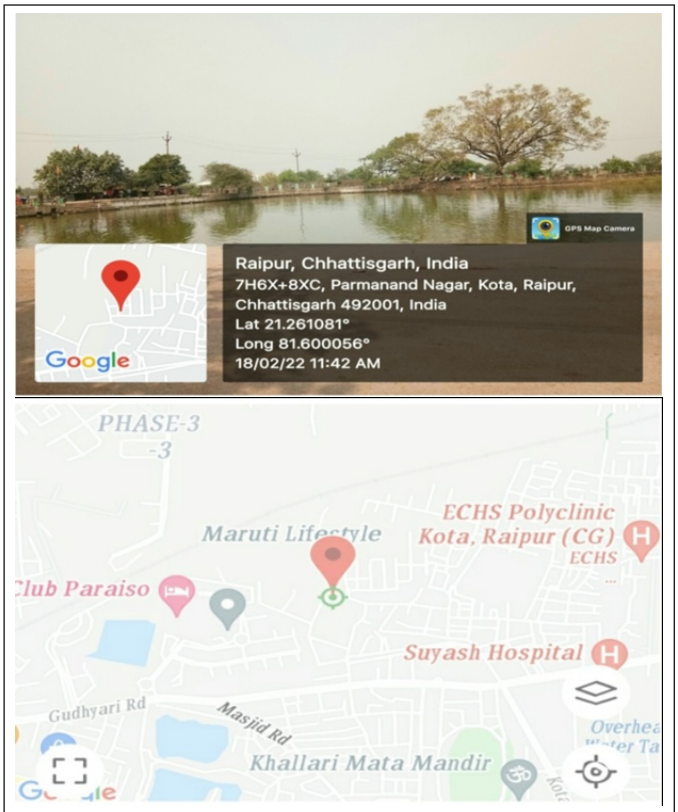

Figure 1: Study Area for water sample Collection

2.2 Sample collection:

The waste water samples were taken in the afternoons between 11 a.m. and 12

p.m. during the month of February For physico-chemical analysis, water samples were obtained at four places. The grab water samples were collected in plastic bottles. The bottles were completely cleaned with hydrochloric acid, rinsed twice with distilled water, rinsed again with the water sample to be collected, and then filled with the sample, leaving just a little air space at the top. Stoppard sample bottles were used, and paraffin wax was used to seal them.

3. RESULTS AND DISCUSSION:

The physico-chemical parameters such as pH, electric conductivity, alkalinity, dissolved oxygen, total dissolve solid, turbidity, biological oxygen demand, nitrate and total hardness of water were analysed for the water samples collected from the parmanand nagar Pond, Raipur.

3.1 pH:

The strength of an acidic or basic character of a solution at a certain temperature is defined as pH. The negative logarithm of hydrogen ion concentration (pH=-log [H^+]) is used to calculate pH. The pH of water samples ranges from 7.5 to 8.3, and it is significant for biotic communities since most plant and animal species can survive in a limited range of pH from slightly acidic to slightly alkaline conditions [11].

3.2 Total Dissolved Solids (TDS):

Total dissolved solids (TDS) is a measurement of the molecular, ionised, or micro-granular (colloidal sol) suspended content of all inorganic and organic compounds present in a liquid. TDS levels are frequently expressed in parts per million (ppm). TDS concentrations in water may be measured with a digital meter [12]. In the measured water, total dissolved solids varied from 230 to 237 mg/l. Due to the inclusion of organic matter and solid waste, the maximum TDS observed was 237 mg/l and the lowest TDS reported was 230 mg/l.

3.3 Electrical Conductivity (EC):

Water capability to transmit electric current is known as electrical conductivity and serves as tool to assess the purity of water [13]. This ability depends on the presence of ions, their total concentration, mobility, valence, relative concentrations and temperature of measurement [14]. The electrical conductivity ranged from 236 to 244 us/cm. The highest electrical conductivity was reported 244 us/cm due to the addition of domestic wastage and lowest 236 us/cm.

3.4 Alkalinity:

The ability of water to withstand acidification is known as alkalinity. It's not to be confused with basicity, which is a pH scale absolute measurement. The strength of a buffer solution made up of weak acids and their conjugate bases is referred to as alkalinity. [15-16] It's calculated by titrating a solution with an acid like HCl until the pH changes suddenly, or until it hits a specified endpoint. Alkalinity is expressed in units of concentration, such as meq/l (milliequivalents per liter), μeq/kg (microequivalents per kilogram), or mg/l $CaCO_3$ (milligrams per liter calcium carbonate). Each of these measurements corresponds to an amount of acid added as a titrant. [17]. The Alkalinity in the water samples ranged from 158 to 166 mg/l. the highest alkalinity recorded was 166 mg/l due high nutrients in water and lowest recorded alkalinity was 158 mg/l.

3.5 Dissolved oxygen (DO):

The amount of oxygen dissolved in water is referred to as dissolved oxygen (DO). The atmosphere and aquatic vegetation both provide oxygen to water bodies. Running water, such as a fast-moving stream, dissolves more oxygen than motionless water, such as that found in a pond or lake. The amount of free, non-compound oxygen contained in water or other liquids is referred to as dissolved oxygen. Free oxygen (O_2), also known as non-compound oxygen, is oxygen that is not bound to any other element [18].The dissolved oxygen in water samples, highest amount recorded was 5.44 mg/l and the lowest dissolved recorded was 5.32 mg/l.

3.6 Biochemical Oxygen Demand (BOD):

The quantity of dissolved oxygen (DO) required (i.e. requested) by aerobic biological organisms to break down organic material present in a given water sample at a particular temperature during a certain time period is known as biochemical oxygen demand (BOD). The BOD value is generally represented in milligrammes of oxygen used per litre of sample over a 5-day incubation period at 20°C, and it is frequently used as a proxy for the degree of organic pollution in water [19]. The biochemical oxygen demand reported from water samples was ranged between 5.12 to 5.23 mg/l. The highest demand of oxygen in the water was recorded was 5.23 mg/l. The lowest demand was recorded was 5.12 mg/l.

3.7 Chemical Oxygen Demand (COD):

The oxidation of reduced compounds in water is measured by the Chemical Oxygen Demand (COD). It is often used to quantify the quantity of organic compounds in water in an indirect manner. COD is a metric that determines the amount of organic materials in water. As a result, COD may be used to detect organic contamination in surface water [20]. The COD in water samples are recorded in ranged between 9.2 mg/l to 9.9 mg/l.

3.8 Turbidity:

Turbidity, like smoke in the air, is the cloudiness or haziness of a fluid generated by a vast number of small particles that are normally undetectable to the human eye. Turbidity is an important indicator of water quality. Turbidity (or haze) is a term used to describe the appearance of translucent substances such as glass or plastic. Haze is defined as the fraction of light deflected more than 2.5 degrees from the entering light direction in plastic manufacture [21]. The turbidity in water samples are recorded in range between 2.87 (NTU) to 2.97 (NTU).

3.9 Total Hardness:

Water with a high mineral concentration is referred to as hard water (in contrast with "soft water"). Hard water is created when water percolates through deposits of calcium and magnesium carbonates, bicarbonates, and sulphates found in limestone, chalk, or gypsum. Drinking hard water may provide some health benefits. In industrial settings, where water hardness is monitored to minimise costly breakdowns in boilers, cooling towers, and other water-handling equipment, it can cause serious difficulties[22]. The total hardness in water samples are recorded in range between 217 to 225.

Table 1: Physico-Chemical Parameters of collected Water Samples

Parameters	Sample-1	Sample-2	Sample-3	Sample-4	Average value
EC (mg/l)	236	239	240	244	240
TDS (mg/l)	230	233	234	237	234
pH	7.5	7.8	7.9	8.3	7.9
Alkalinity (mg/l)	158	161	163	166	163
DO (mg/l)	5.32	5.36	5.38	5.44	5.38
BOD (mg/l)	5.12	515	5.17	5.23	5.17
COD (mg/l)	9.2	9.4	9.5	9.9	9.5
Turbidity (NTU)	2.87	2.90	2.93	2.97	2.93
Total Hardness	217	220	221	225	221
Temporary Hardness	137	139	141	146	141
Permanent Hardness	81.4	82.9	83.0	84.6	83.0

3.9.1 Temporary hardness:

The presence of dissolved bicarbonate minerals causes temporary hardness (calcium bicarbonate and magnesium bicarbonate). When these minerals are dissolved, they produce calcium and magnesium cations (Ca^{2+}, Mg^{2+}) as well as carbonate and bicarbonate anions (CO_3^{2-} and HCO_3^-). Water becomes hard due to the presence of metal cations. Unlike the permanent hardness generated by sulphate and chloride compounds, however, this "temporary" hardness may be decreased by boiling the water or adding lime (calcium hydroxide) to the water through the lime softening process. Boiling encourages the synthesis of carbonate from bicarbonate and the precipitation of calcium carbonate out of solution, resulting in softer water when cooled [23]. The temporary hardness in water samples are recorded in range between 137 to 146.

3.9.2 Permanent hardness:

Boiling is often difficult to eliminate permanent hardness (mineral content). The presence of calcium sulfate/calcium chloride and/or magnesium sulfate/magnesium chloride in the water, which do not precipitate out when the temperature rises, is frequently the cause. A water softener or an ion-exchange column can be used to remove ions that cause persistent hardness in water [24]. The permanent hardness in water samples are recorded in range between 81.4 to 84.6.

4. CONCLUSION:

The study reveals that the water samples which are collected from Parmanand Nagar, Pond, kota, Raipur (C.G) is deteriorated very badly as a result of addition of urban, domestic and industrial wastes. Direct discharge of human and animal waste not only imparts the quality of water but also affects the health of the people because these water is used for washing, bathing and sometimes for drinking purposes. The water samples which are tested and its parameters are recorded as follows: the pH range from 7.5 to 8.3. The TDS ranged from 130 to 137 (mg/l) and Alkalinity, BOD and COD are ranges from 158 to 166 (mg/l), 5.12 to 5.23 (mg/l) and 9.2 to 9.9 (mg/l) respectively. It is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose.

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